



[6450-01-P]

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

**Challenges and Opportunities for Sustainable Development of Hydropower in
Undeveloped Stream Reaches of the United States; Request for Information**

AGENCY: Water Power Technologies Office, Office of Energy Efficiency and Renewable Energy, Department of Energy (DOE).

ACTION: Request for information (RFI).

SUMMARY: The Water Power Technologies Office (WPTO), within the Department of Energy (DOE) is issuing this request for information (RFI) to invite input from the public regarding challenges and opportunities associated with hydropower development in undeveloped stream-reaches. Through this RFI, the WPTO is also seeking input on the focus and structure of a potential funding opportunity to support research and development of advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects of new cost-competitive hydropower development in undeveloped stream-reaches of the United States.

DATES: Responses must be received no later than 5:00pm (ET) on Friday, December 16, 2016.

ADDRESSES: Responses to this RFI must be submitted electronically to HydroNextFOA@ee.doe.gov as Microsoft Word (.docx) attachments to an email, and no more than 6 pages in length, 12 point font, 1 inch margins. It is recommended that attachments with file sizes exceeding 25 MB be compressed (i.e., zipped) to ensure message delivery. Please include in the subject line “Comments for RFI”. Only electronic responses will be accepted.

FOR FURTHER INFORMATION CONTACT: Questions may be directed to:

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SUPPLEMENTARY INFORMATION:

Table of Contents

- I. Background
- II. Purpose
- III. Request for Information Categories and Questions
- IV. Guidance for Submitting Documents

I. Background

Through its HydroNEXT initiative, WPTO's Hydropower Program (the Program) invests in the development of innovative technologies that lower cost, improve performance, and promote environmental stewardship of hydropower development across three resource classes:

- Existing non-powered dams (NPD)
- Pumped storage hydropower (PSH)
- New stream-reach development (NSD)

Under a Fiscal Year (FY) 2016 Funding Opportunity Announcement (FOA) DE-FOA-0001455 titled, "Innovative Technologies to Advance Non-Powered Dam and Pumped Storage Hydropower Development," the Program made federal funding available to research and develop innovative solutions for NPD and PSH development. In FY 2017, the Program seeks to overcome challenges associated with furthering the development of hydropower in new stream-reaches.

Development of hydropower in new stream-reaches refers to new projects in stream segments and waterways that do not currently have hydroelectric facilities. New stream-reach development projects are subject to more scrutiny than projects for other hydropower resources (i.e. NPDs, refurbishments) because such development can have more extensive environmental and social effects, particularly if construction of a dam or diversion is required. Construction of barriers in a natural waterway can affect fish migration, channel geomorphology, sediment transport, habitat connectivity, water quality, and flow regimes. The unique nature of new stream-reach development can also add cost, time, and uncertainty to the development process. These factors have hindered the development of this resource in recent decades.

To realize sustainable and responsible hydropower development and to protect the integrity of existing streams, the Program is seeking information regarding transformative and/or innovative hydropower technologies that reduce or eliminate environmental concerns and are financially viable.

II. Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on issues related to development of hydropower in new stream-reaches. EERE is specifically interested in information on the costs/benefits and environmental effects associated with such development, and possible solutions to address the related challenges. EERE is also seeking input on the focus and structure of a potential funding opportunity to support research and development of advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects of new cost-competitive hydropower development in undeveloped stream-reaches of the United States. This is solely a request for information and not a Funding Opportunity Announcement (FOA); EERE is not accepting applications.

III. Request for Information Categories and Questions

A. Category 1: New Stream-Reach Development (NSD) Challenges and Opportunities

To accelerate the deployment of sustainable and responsible hydropower in new stream-reaches while protecting their social and environmental value, EERE is seeking input on the main challenges and potential opportunities for developing this resource.

Specifically, we welcome feedback on the following questions:

- 1) How can advances in technology more readily address environmental challenges associated with hydropower development in undeveloped streams?
- 2) What are the technical challenges associated with new stream-reach development? How can DOE help address these challenges?
- 3) How can modularization of power train and civil works components affect project costs?
How can standardized equipment build familiarity and assist with regulatory review of proposed new stream-reach development projects?
- 4) With recent advancements in additive manufacturing, it has become increasingly easy to embed sensors and other smart technology into equipment. How can this advancement be used to build smarter machines and change the way stakeholders address environmental concerns?
- 5) What other challenges is the hydropower community facing with regards to new stream-reach development? How can DOE help to address those challenges?

B. Category 2: Transformative Hydropower Innovations

The DOE's 2016 *Hydropower Vision* analysis¹ found that deployment of 1.7 gigawatts (GW) of new stream-reach development is possible by 2050 based on a scenario in which technology advancements lower capital and operating costs, innovative market mechanisms increase revenue and lower financing costs, and environmental considerations are taken into account. Further, alternative scenarios explored in the *Hydropower Vision* analysis also showed new stream-reach development could increase by an additional 15.5 GW by 2050 if a substantial level of transformative technological innovation were developed to successfully address the cost and environmental considerations associated with new stream-reach development.

We are seeking input on the following questions related to this issue:

- 1) What type of transformative innovations (either in power train components or plant system designs) could hold the key to reducing or avoiding environmental effects typically associated with development of new stream-reaches?
- 2) How can Federal investments in research and development help increase benefits and reduce costs for new stream-reach development? What areas of investment would be most impactful?

¹ The 2016 *Hydropower Vision* analysis involved more than 50 modeled scenarios, each examining the effects of key variables or combination of variables that influence the deployment of hydropower facilities in electricity market competition with other generation sources. <http://energy.gov/eere/water/articles/hydropower-vision-new-chapter-america-s-1st-renewable-electricity-source>

- 3) Are other industries using technologies, equipment, or techniques that could be applied to hydropower to increase benefits and/or reduce new stream-reach development project costs, timelines, and environmental effects? Please provide examples.

C. Category 3: Potential Funding Opportunity

EERE seeks input on the focus and structure of a potential funding opportunity to support the development of environmentally-sustainable hydropower development in new stream-reaches. EERE welcomes feedback on the approach outlined below.

The objective of this potential research is to develop advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects for new cost-competitive hydropower development in undeveloped stream-reaches of the United States. Potential projects should be capable of reducing the environmental and social effects of civil works and other disturbances resulting from the development of hydropower in undeveloped stream-reaches. Of particular interest are projects that do not require the use of a dam to create the head differential necessary to generate hydropower.

Following a two-phase process, potential researchers should be able to demonstrate—through research, analysis, and engineering design—that the proposed systems can meet the following metrics:

1. Environmental and Social Impact²
2. Technical Feasibility
3. Cost Competitiveness

Phase 1 (12 months):

Research the available hydropower potential and develop innovative and transformative design strategies that include ways to increase head for cost-competitive and environmentally sustainable hydropower development. Such designs should include the following features:

- Transformative diversionary structures without the use of a solid dam: examples include side intakes or side-channel intakes and headrace canals, and trench weirs with suitable water conveyance systems
- Alternative water conveyance systems using innovative technologies (such as advanced tunneling methods, intakes, alternative pipe materials and manufacturing, and tailrace systems) to increase power density and reduce component and system costs
- Use of low impact, modular, and scalable hydropower technologies as applicable to achieve cost reductions

Researchers should consider multipurpose use of the hydropower facility that may help to reduce the cost allocation to hydropower development.

² Environmental and Social Impact refers to how construction and operation of a project affects geomorphology, water quality, and the function of streams in supporting social objectives (e.g., recreation) and species reproduction.

Further, awardees will perform desktop studies using available data to identify probable locations on undeveloped stream-reaches for potential application of their innovative/transformational design strategies. These studies will help to identify the most favorable sites and inform reconnaissance and feasibility studies in Phase 2.

Phase 2 (12-18 months):

With respect to the most favorable sites identified in Phase I, researchers should perform: A) Reconnaissance studies, and B) Feasibility studies.

A. Reconnaissance Studies

Reconnaissance studies are performed with the aim of determining if further feasibility studies are warranted. These studies should:

1. Scope the extent of study necessary for hydropower site development and preliminary economic analysis
2. Develop a preliminary layout (plan and cross-section)
3. Assess the head and flow (site hydrology)
4. Determine the type of turbine-generator for the head and flow for the purpose of obtaining typical equipment costs
5. Estimate preliminary power potential
6. Evaluate the transmission requirements at a high level for power take-off
7. Assess potential environmental and social impacts and related mitigation
8. Develop a high level cost estimate

9. Estimate potential revenue streams
10. Determine economic feasibility including possible financing costs
11. Include a report to document reconnaissance findings

B. Feasibility Studies

Feasibility studies are performed with the aim of determining if an investment commitment should be made without actual ground disturbance and the requirement of permit(s). These studies will include the following activities:

1. A firm-up of the project layout to include alternate sites based on actual preliminary site investigations
2. Confirmation of the project parameters such as:
 - a. head
 - b. flow duration and unit flow
 - c. number and type of units
 - d. installed capacity
 - e. water conductor system and ancillary equipment and other physical work
 - f. transmission routing and associated equipment needs
3. Identification of site development needs
4. Evaluation of power purchase alternatives
5. Potential environmental and social impact studies and related mitigation
6. Detailed preliminary cost studies
7. Evaluation of possible multi-use of the facility

8. Determination of economic feasibility including possible financing costs
9. Preparation of a report to document feasibility findings

Researchers should perform reconnaissance studies for at least six selected locations for project development, with the aim of performing feasibility studies on the three most promising sites. We anticipate that DOE would make a Go/No-Go decision after Phase 1 based on the environmental performance, costs, and applicability of the proposed technology or design strategy.

EERE welcomes input on the approach outlined. Specifically, we welcome feedback on the following questions:

- 1) Is the focus outlined above the optimal approach for supporting sustainable development of hydropower in undeveloped streams? If not, what improvements would you suggest?
- 2) Please share comments on other items not considered here that you believe EERE should address as it develops a strategy to advance new stream-reach development.

IV. Guidance for Submitting Documents

DOE invites all interested parties to submit responses by not later than 5:00 pm (ET) on December 16, 2016. Responses to this RFI must be submitted electronically to HydroNextFOA@ee.doe.gov as Microsoft Word (.docx) attachments to an email, and no more than 6 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted. Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.

Issued in Washington, DC on November 3, 2016.

Jim Ahlgrimm

Acting Director, Water Power Technologies Office

Office of Energy Efficiency and Renewable Energy

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